Microsoft

Azure Developer Community Call

Cosmos DB Ask Me Anything
November 10th 2022

Contents

- How to design applications that are suited for Cosmos DB
- When Cosmos DB is not the right choice
- How to choose the right API and SDKs
- Global distribution vs. consistency model
- SLA and predicatable latency guarantees (what it really means)
- Elasticity and provision throughput vs. data modeling and query design

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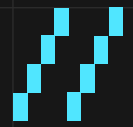


CosmosDB Ask Me Anything

Microsoft

Azure Cosmos DB

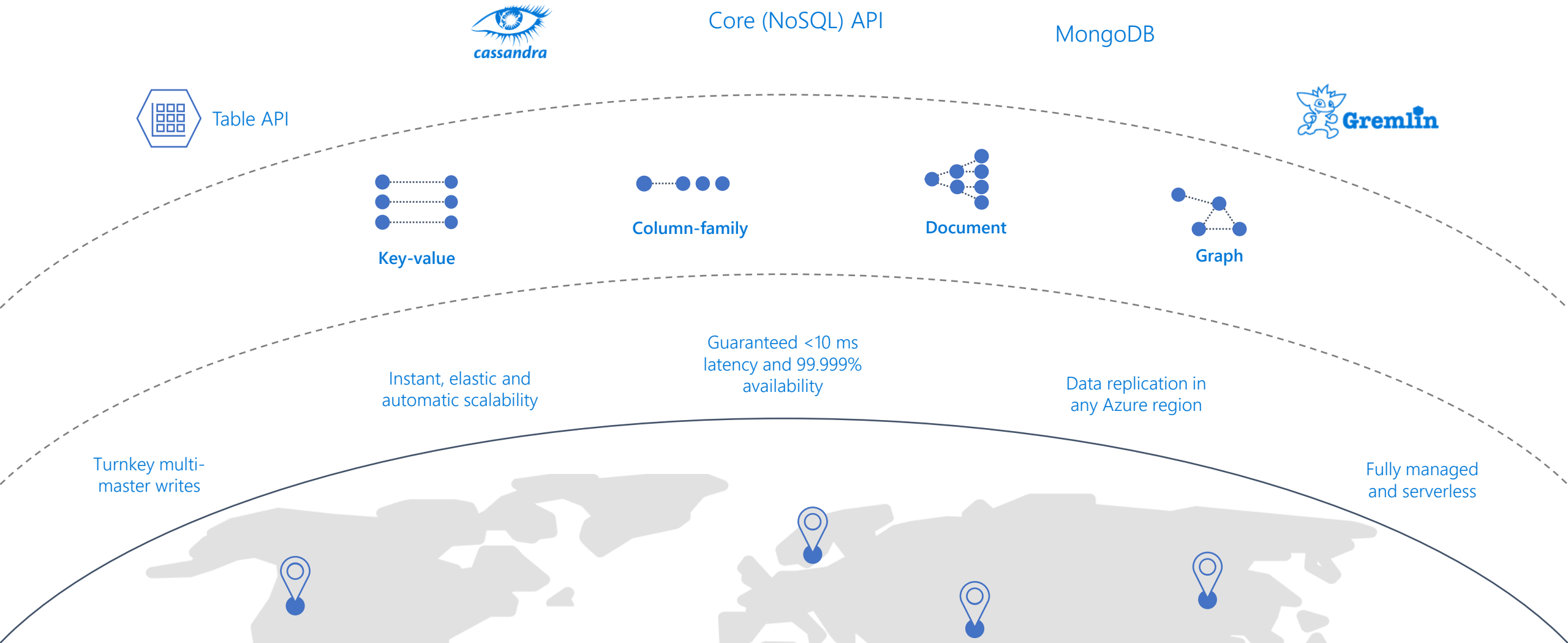
Ask Me Anything...

Fabian Meiswinkel – fabianm@microsoft.com

10.11.2022

AZURE COSMOS DB

Fast NoSQL database with open APIs for any scale

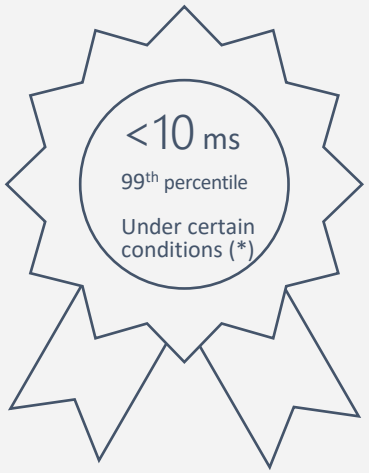


COMPREHENSIVE SLAs

RUN YOUR APP ON WORLD-CLASS INFRASTRUCTURE

Azure Cosmos DB is the only service with financially-backed SLAs for single-digit millisecond read and write latency at the 99th percentile, 99.999% high availability and guaranteed throughput and consistency

Latency



High Availability

Throughput

Consistency

(*) SQL Api, point operations for documents <= 1 KB, SDK with direct mode, compute client in same Azure region, Azure Accelerated Networking enabled, sufficient client-side compute capacity

SLA: https://azure.microsoft.com/en-us/support/legal/sla/cosmos-db/

PROVISIONED THROUGHPUT

- Expected throughput has to be **provisioned** (* except for Serverless)
- Expressed in **Request Units per second** (RU/s)
  - Represents the "cost" of a request in terms of CPU, memory and I/O
- Throughput can be provisioned:
  - at the database-level
  - at the container-level
- Provisioned throughput **can be changed programmatically** with API calls – and the decision how many RU/s to provision van be made manually or via auto-scale
- Design decisions like number of regions, single vs. multi-master, data model, consistency model, API choice can and will have impact on RU/s usage – so, implicitly cost
- More info:
  - https://learn.microsoft.com/en-us/azure/cosmos-db/how-to-choose-offer
  - https://learn.microsoft.com/en-us/azure/cosmos-db/throughput-serverless

How to design applications that are suited for Cosmos DB vs. when is it not the right choice?

- Sweet spot: Mission critical OLTP workloads
  - Relatively high percentage of point operations or queries targeting single logical partition
  - Geo distribution is needed
  - Latency sensitive
  - Elasticity/scale demanding
- Useful capabilities to extend applicable scenarios
  - Query engine/Indexing even when being schema-less
    - https://learn.microsoft.com/en-us/azure/cosmos-db/index-overview
    - https://learn.microsoft.com/en-us/azure/cosmos-db/nosql/query/getting-started
  - Azure Synapse Link - https://learn.microsoft.com/en-us/azure/cosmos-db/synapse-link
- When Cosmos DB is not a good fit
  - Real-time analytics (requiring cross-partition queries over large data set (TBs or more)
    - RU/s are the virtual currency for CPU and I/O – real-time analytics scenarios often are very I/O hungry – which in Cosmos DB means the provisioned throughput (RU/s) in Cosmos for CPU and I/O is used simply for I/O – making I/O more expensive than alternatives
    - Better alternatives depending on workload can be Kusto/Data-Explorer, native Mongo (sharding tends to have fewer but larger shards, making aggregation pipeline more compelling in those scenarios) or Azure Sql and/or Postgres
  - Cold-storage scenarios – you have to provision at least 1 RU/GB of data stored. In cold-storage scenarios – PBs of data – very little throughput, this can also result in higher cost than when using Azure Storage (Table or Blob) for example

How to choose the right API and SDKs?

- APIs (decided on account creation, immutable, usually not interchangeable)
  - NoSql/Core – Api
    - All capabilities, best performance (only API covered under 10ms end-to-end latency SLA for point operations)
  - Mongo/Cassandra
    - OSS APIs – allowing to avoid vendor lock-in
    - Mongo and Cassandra APIs are not native Mongo or Cassandra - be careful with lift & shift
      - Mongo 4.2: https://learn.microsoft.com/en-us/azure/cosmos-db/mongodb/feature-support-42
      - Mongo 4.0: https://learn.microsoft.com/en-us/azure/cosmos-db/mongodb/feature-support-40
      - Mongo 3.6: https://learn.microsoft.com/en-us/azure/cosmos-db/mongodb/feature-support-36
      - Cassandra: https://learn.microsoft.com/en-us/azure/cosmos-db/cassandra/support
  - Table API
    - effectively a subset of NoSQL Api
    - only for migrations of existing apps using Azure Table Storage)
  - Gremlin API
    - Internally using NoSQL Api (Using NoSQL Api to query/write technically possible)
    - For graph-based queries

How to choose the right global distribution config and consistency model?

- https://learn.microsoft.com/en-us/azure/cosmos-db/distribute-data-globally
- https://learn.microsoft.com/en-us/azure/cosmos-db/high-availability
- https://learn.microsoft.com/en-us/azure/cosmos-db/global-dist-under-the-hood

- Multi-regional accounts
  - Number of regions → multiplier on cost
- Single-master vs. multi-master
  - 100 RU/s for multi-master are twice as expensive as for single-master
- Auto-scale vs. manually provisioning throughput
  - 100/RU/s for Auto-Scale are 1.5 times as expensive as for manual throughput
- Pricing: https://azure.microsoft.com/en-us/pricing/details/cosmos-db/autoscale-provisioned/
- Consistency-level
  - Consistency levels: https://learn.microsoft.com/en-us/azure/cosmos-db/consistency-levels
  - Strong is the only consistency level resulting in synchronous replication
  - Bounded staleness and strong have twice the RU/s charge for reads/queries

How to optimize the data model and query design to reduce RU/s usage?

- Choice of partition/shard key is critical
  - The more unique partition key values the better
  - Avoiding cross partition key queries on the hot path
  - For Cosmos DB: only documents within the same logical partition can be included in multi-document transaction
  - https://learn.microsoft.com/en-us/azure/cosmos-db/partitioning-overview
- Queries
  - Indexing – tune by removing unnecessarily indexed paths and adding useful composite indexes → https://devblogs.microsoft.com/cosmosdb/query-performance-indexing-metrics/
- Wherever possible prefer point-read over query for better throughput/latency/lower RU-charge
- Analytics store (Azure Synapse Link) can be useful for scan-heavy queries/workloads (no RU charge) → https://learn.microsoft.com/en-us/azure/cosmos-db/synapse-link
- Consistency level for individual requests/operations can always be reduced – choose Eventual where functionally possible to reduce the RU-charge